Royal Netherlands Meteorological Institute
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Continuing the Aerosol Index data record with TROPOMI: comparison with OMI and other instruments

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1. TROPOMI UV Aerosol Index

The TROPOMI UV Aerosol Index (AI) is designed to continue the long data multi-sensor data record of the aerosol index which includes OMI (see Figure x). The AI is well-suited to capture plume dynamics in great detail for UV-absorbing aerosols including smoke, dust and volcanic ash (see **Figure 1**).

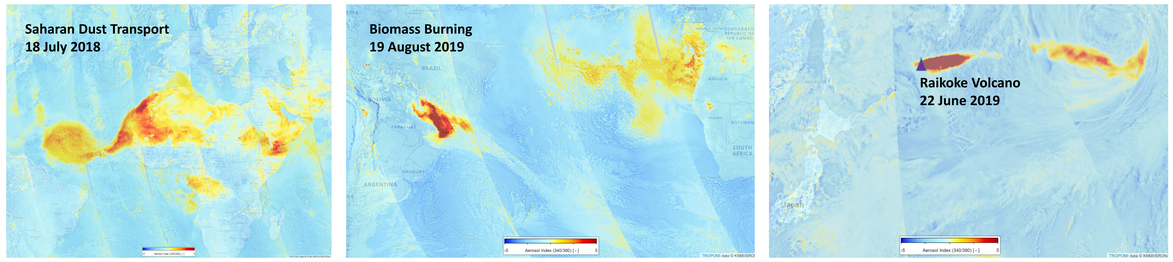


Figure 1. Examples of the TROPOMI UV Aerosol index for desert dust 18 Jul 2018 (left), biomass burning 19 Aug 2019 (middle) and Raikoke volcanic eruption 22 Jun 2019 (right).

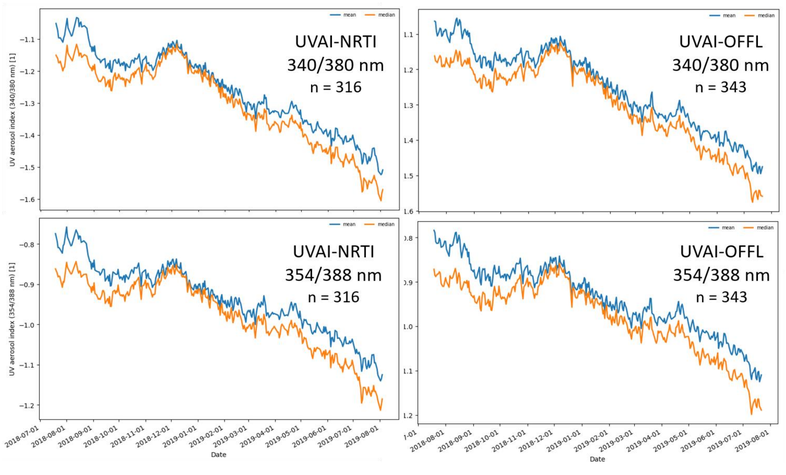
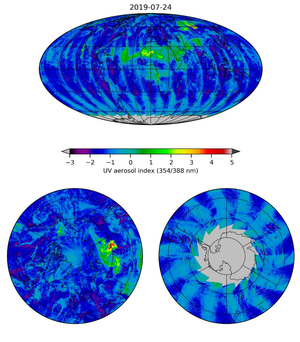
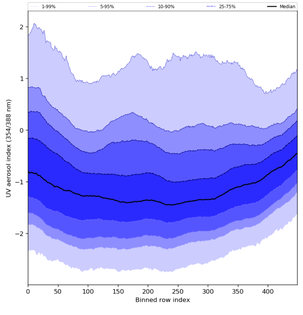


Figure 2. Because the aerosol index is very sensitive to the absolute radiance, monitoring the global mean is good indicator of the state of the calibration. Here at left you see the global mean & median throughout the operational phase of TROPOMI for both NRTI & OFFL data products. There is a known wavelength-dependent degradation (greater at shorter wavelengths that affects the TROPOMI AI. This leads to a negative bias in the data, but this effect which is currently increasing over time will be accounted for with the L1b 2.0.0 update late-2019.

Quality control information is available for the TROPOMI AI and all released data products via the tropomi.eu website here: http://mpc-l2.tropomi.eu

You can download quicklooks, and diagnostic plots like the ones show here at left from 24 July 2019 when there were extensive fires in Russia.





Resources: Keep up-to-date with TROPOMI data product developments on www.tropomi.eu; All publically released TROPOMI data can be downloaded here: https://scihub.copernicus.eu/

2. Comparison with OMI and OMPS

The aerosol index can only be verified by means of intercomparison with aerosol index data as measured by other satellite instruments. The latest version of the TROPOMI quarterly validation report including comparison to OMI and OMPS data can be found here: www.tropomi.eu/documents/validation

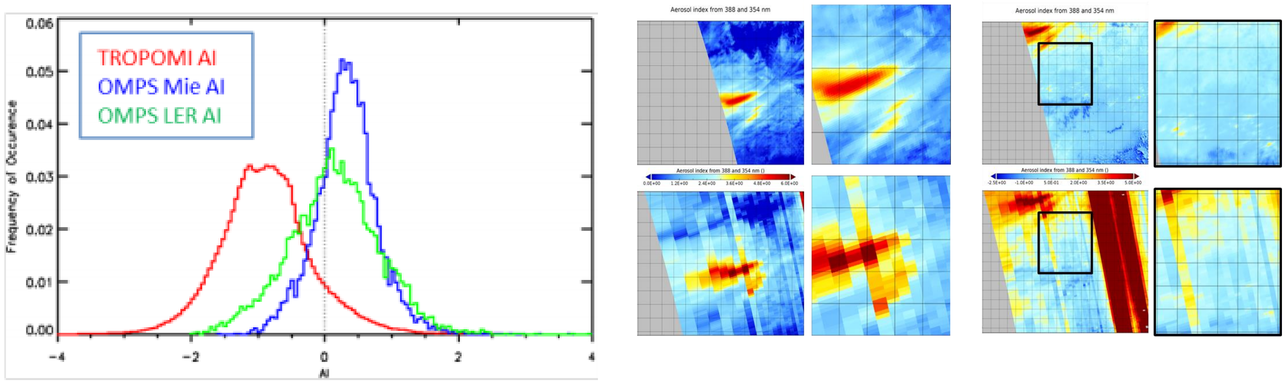


Figure 3. Comparison of TROPOMI UVAI and OMI OMAERO UV aerosol index for a Saharan case study (10 Nov 2017) two set of four panels on right; gridlines are 1x1 degree. Left panel show the comparison of OMPS for the same case study.

Satellite Instrument	Years in Operation
TOMS: Nim-7, EP	1978 – 2004
GOME-2 (A, B, C)	2007 – present
SCIAMACHY	2002 – 2012
OMI	2004 – present
OMPS	2012 – present
TROPOMI	2017 – present
GEMS (Geostationary)	Not yet operational

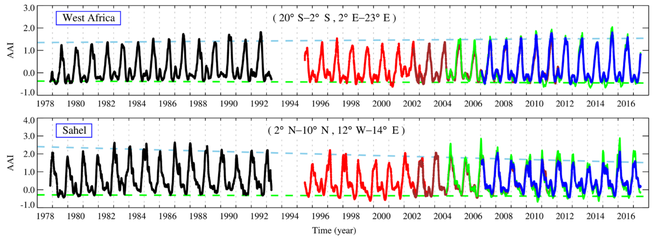


Figure 4. The Multi-Sensor AAI (MS-AAI) data record consists of AAI data from the TOMS, GOME-1, SCIAMACHY, OMI, GOME-2A and GOME-2B instruments. The dataset covers the period 1978-2019 and is updated monthly. The data can be downloaded here: http://temis.nl/airpollution/absaai/#MS_AAI

3. Outlook: next data product updates

For larger pixels sizes from missions prior to TROPOMI, the assumption of a Lambertian surface is sufficient. However, with the smaller pixels (recently reduced to 3.5 x 5.6 km, operational as of 6 August 2019), this is no longer adequate, 3-D cloud effects and terrain effects are sometimes strongly visible.

Cloud Effects: need to be flagged for the user and additional data fields accounting for clouds should be provided (Mie and other approaches are currently being tested).

Updated L1b: As a part of the update of the L1b data 2.0.0 scheduled for late-2019, all Level 2 data products tested, validated and compared to the current versions. Tests show the new version removes the negative bias.

Extended intercomparison: We will continue to compare to OMI and OMPS and we anticipate carrying out future comparisons with the **GEMS** aerosol index and with the **VIIRS** visual aerosol index.